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Veno et al.

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(54) **TAPE CARTRIDGE WITH MOVABLE ACCESS DOOR**

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(51) **Int. Cl.**
G1B 23/04 (2006.01)

(52) **U.S. Cl.** **242/338.2; 242/347.1; 242/348; 360/96.5**

(58) **Field of Classification Search** 242/332, 242/332.1, 332.4, 338, 338.2, 346, 347.1, 242/348.2, 348; 360/95, 96.5, 132
See application file for complete search history.

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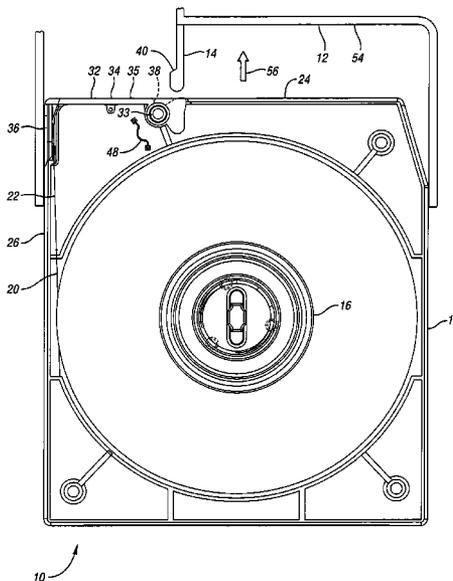
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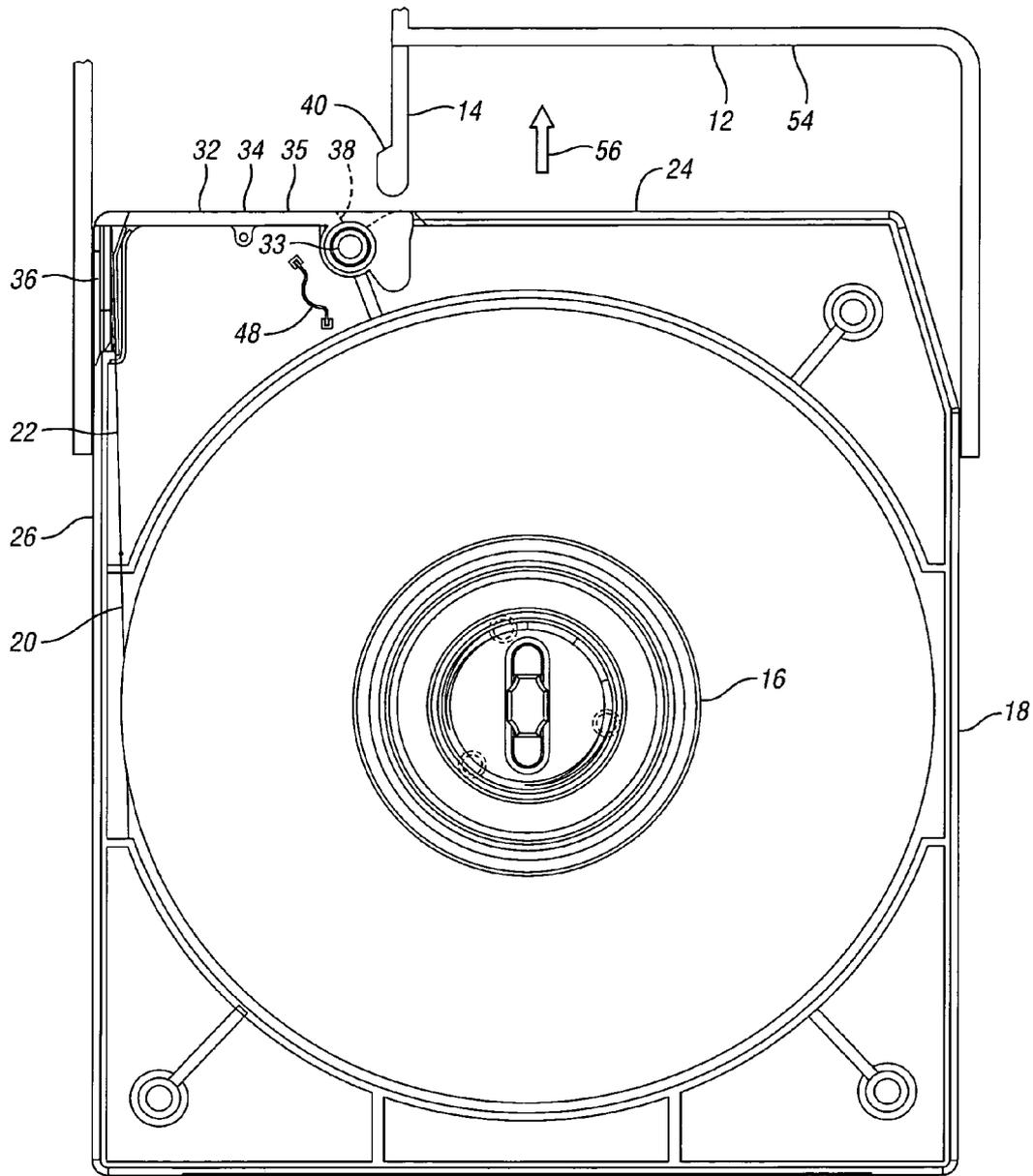
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(57) **ABSTRACT**

A tape cartridge, for use with a tape drive having an actuation member, includes a cartridge body that is insertable into the tape drive and a door movably associated with the cartridge body. The door is engageable with the actuation member when the cartridge body is inserted into the tape drive, and is movable between a closed position and an open position upon engagement with the actuation member. Furthermore, the door includes a retainer that is engageable with the actuation member when the door is in the open position to facilitate retention of the cartridge body in the tape drive.

25 Claims, 4 Drawing Sheets





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Fig. 1

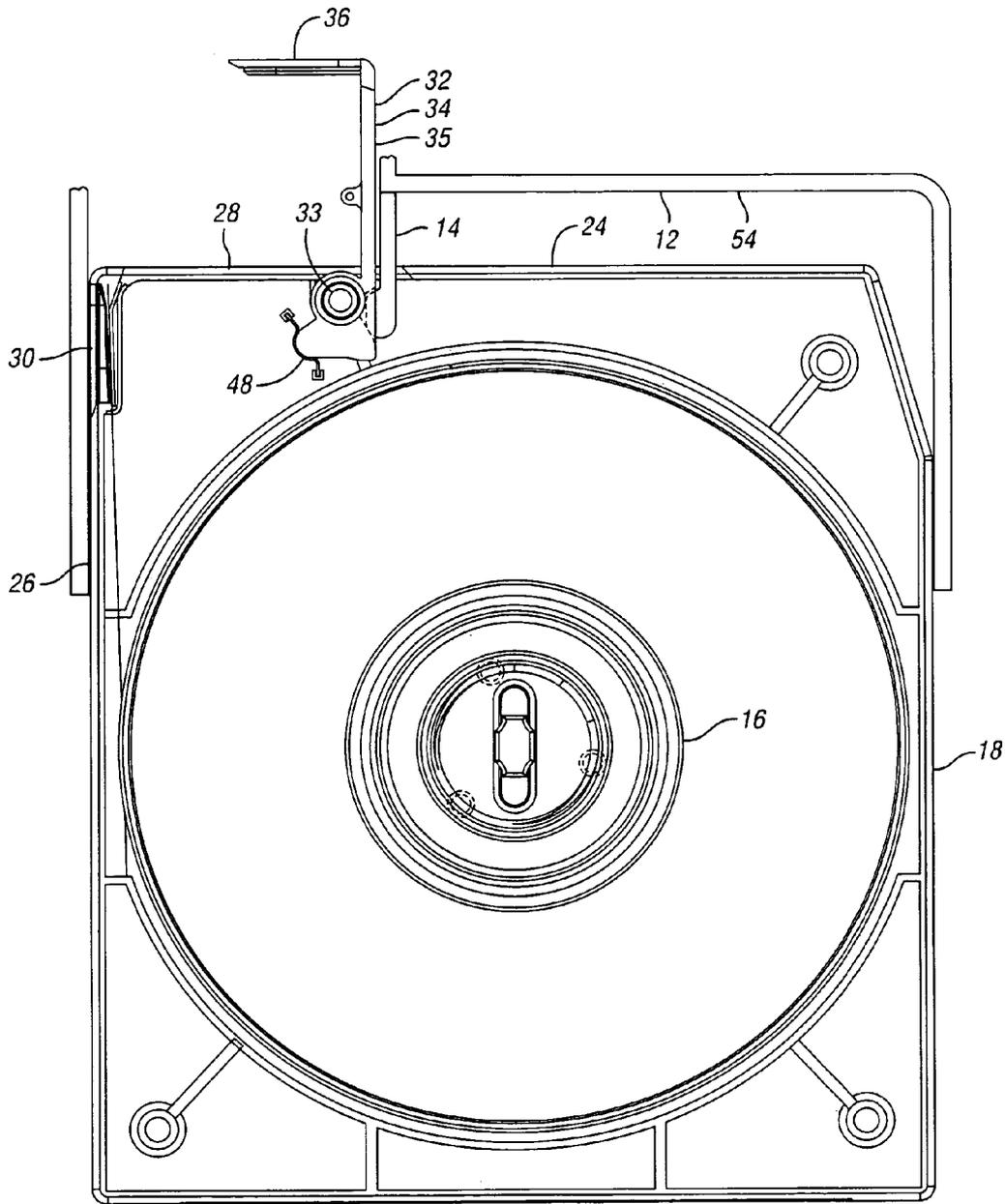


Fig. 2

Fig. 4

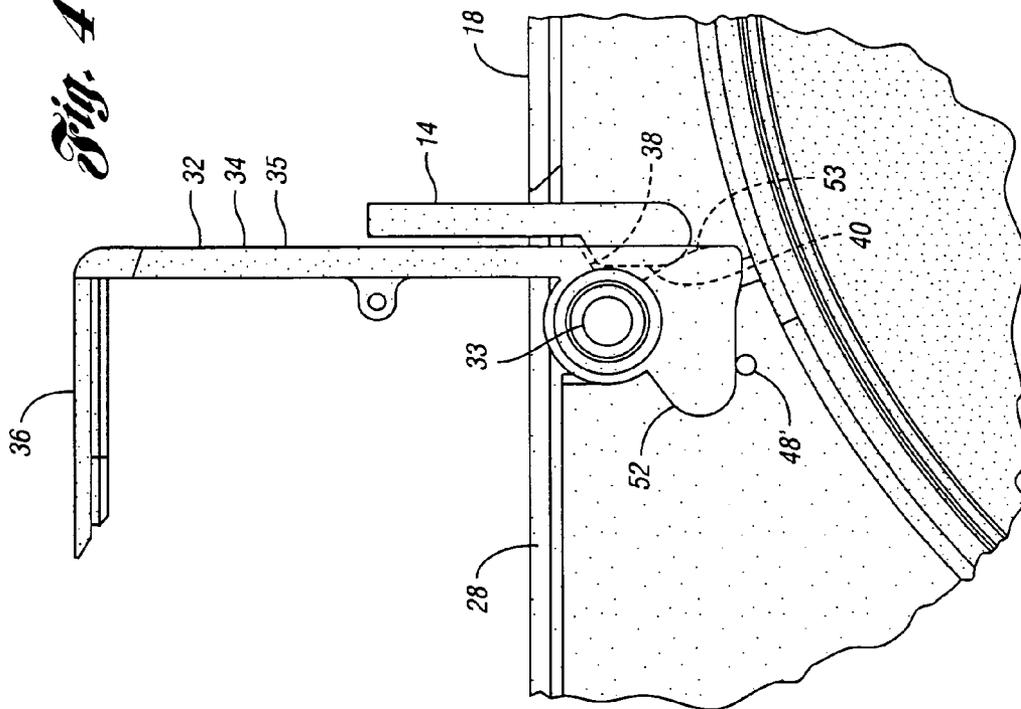
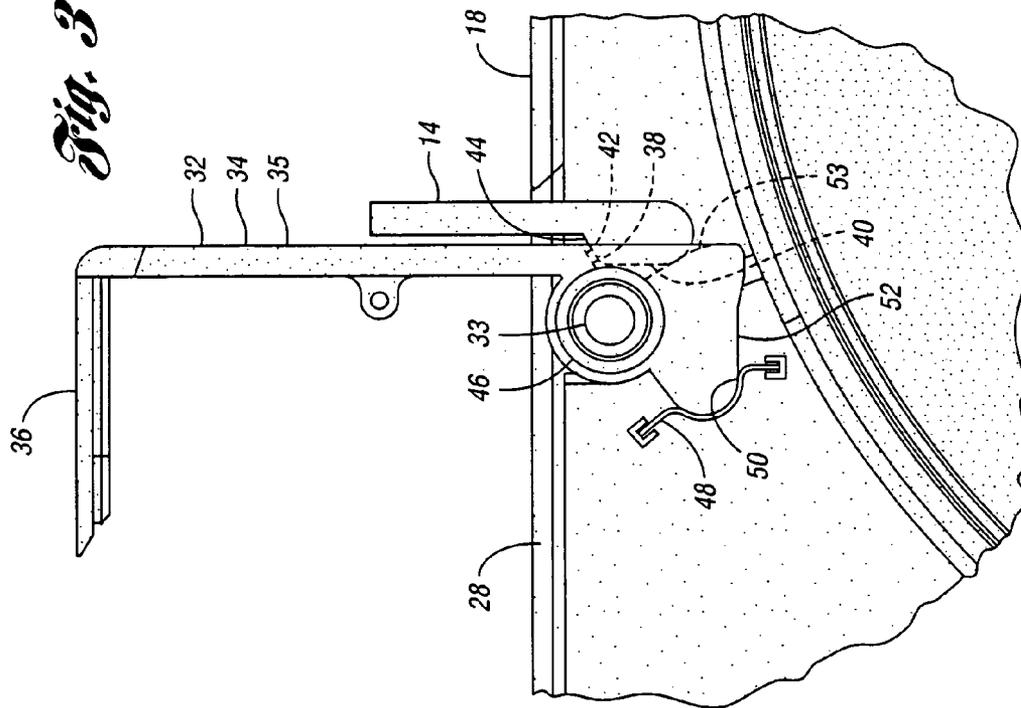
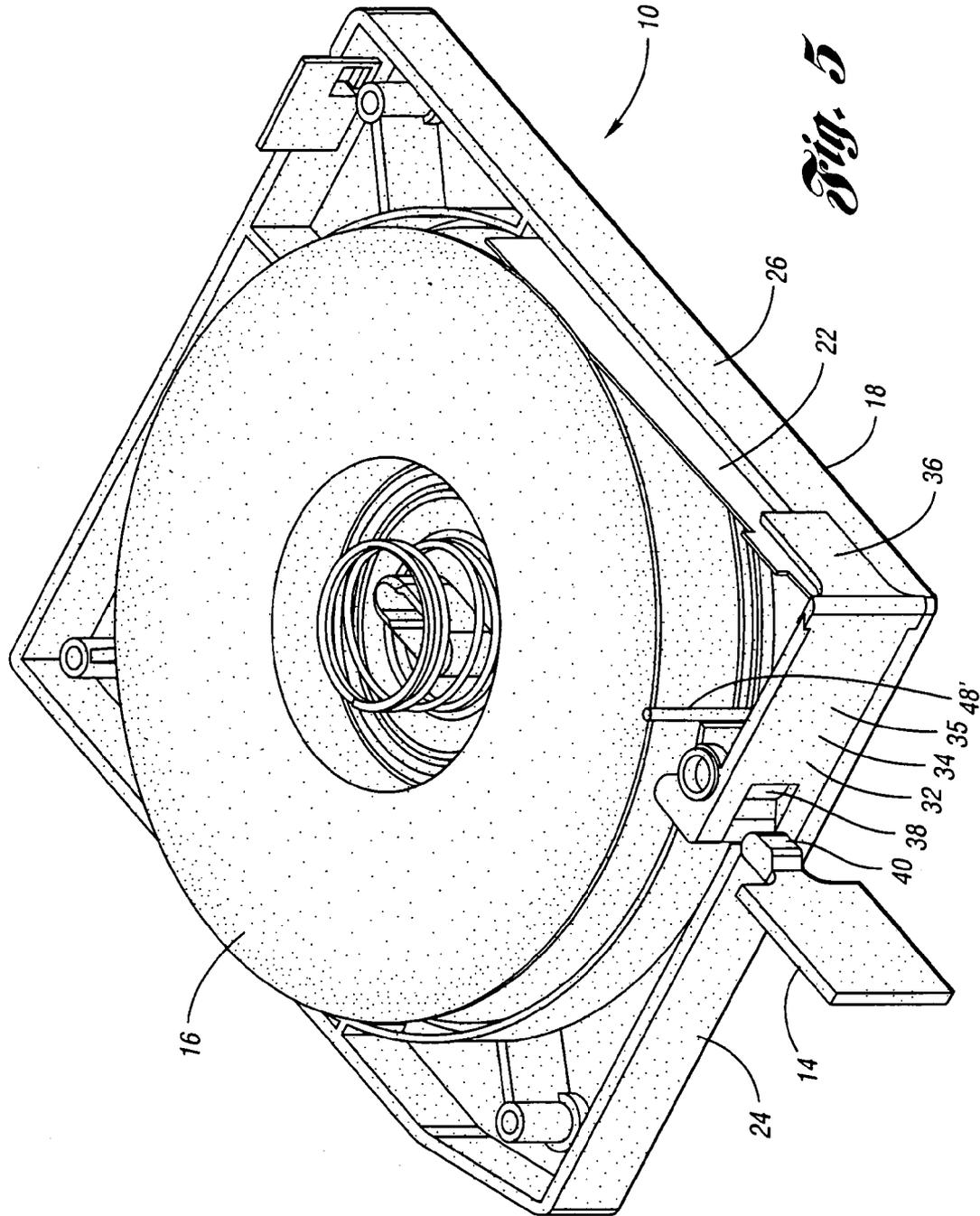


Fig. 3





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TAPE CARTRIDGE WITH MOVABLE ACCESS DOOR

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Provisional Application Ser. No. 60/517,713, which was filed Nov. 4, 2003.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a tape cartridge for use with a tape drive and having an access door.

2. Background Art

A tape cartridge typically includes magnetic tape wound on a supply reel. Data is read from or written to the tape by inserting the cartridge into a tape drive that includes a read/write head. The cartridge may also include an access door to protect the tape from damage. When the cartridge is inserted into the tape drive, the door is opened to expose the tape to the tape drive interior.

One known cartridge includes a pivotable door that opens upon engagement with a tab disposed on a tape drive. The cartridge further includes a hook that is spaced away from the door and that is engageable with a corresponding hook of the drive to retain the cartridge in the tape drive.

SUMMARY OF THE INVENTION

Under the invention, a tape cartridge for use with a tape drive having an actuation member is provided. The cartridge includes a cartridge body that is insertable into the tape drive and a door movably associated with the cartridge body. The door is engageable with the actuation member when the cartridge body is inserted into the tape drive, and is movable between a closed position and an open position upon engagement with the actuation member. Furthermore, the door includes a retainer that is engageable with the actuation member when the door is in the open position to facilitate retention of the cartridge body in the tape drive.

Further under the invention, a tape cartridge, for use with a tape drive having an actuation member, includes a cartridge body that is insertable into the tape drive. The cartridge body has an opening that is configured to allow tape to pass therethrough. A door is movably associated with the cartridge body and is engageable with the actuation member when the cartridge body is inserted into the tape drive. The door is pivotable between a closed position, in which the door at least partially covers the opening, and an open position upon engagement with the actuation member. Moreover, the door includes a retainer that is engageable with the actuation member when the door is in the open position. The cartridge further includes a spring associated with the door for urging the door toward the closed position, and a locking mechanism that is engageable with the door when the door is in the open position for inhibiting movement of the door toward the closed position. The retainer and the locking mechanism cooperate to sufficiently retain the cartridge body in the tape drive.

Still further under the invention, a tape cartridge, for use with a tape drive having an actuation member, includes a cartridge body that is insertable into the tape drive and a door movably associated with the cartridge body. The door is engageable with the actuation member when the cartridge body is inserted into the tape drive, and the door is movable

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between a closed position and an open position upon engagement with the actuation member. The cartridge further includes a movement inhibitor associated with the cartridge body and engageable with the door when the door is in the open position for inhibiting movement of the door toward the closed position.

A tape cartridge and tape drive combination, according to the invention, comprises a tape cartridge including a cartridge body having an opening. The tape cartridge further includes a door movably associated with the cartridge body and being pivotable between a closed position and an open position. When the door is in the closed position, the door at least partially covers the opening. The combination further includes a tape drive configured to receive the tape cartridge. The tape drive includes an actuation member that engages the door and urges the door toward the open position when the tape cartridge is inserted into the tape drive. Moreover, the actuation member extends into the aperture when the door is in the open position.

While exemplary embodiments in accordance with the invention are illustrated and disclosed, such disclosure should not be construed to limit the claims. It is anticipated that various modifications and alternative designs may be made without departing from the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary top view of a system according to the invention including a tape cartridge and a tape drive, wherein the cartridge includes a door that is shown in a closed position;

FIG. 2 is a view similar to FIG. 1 showing the door of the cartridge in an open position;

FIG. 3 is an enlarged view of a portion of the system of FIG. 2, showing the door engaged with a movement inhibitor of the cartridge;

FIG. 4 is a view similar to FIG. 3 showing an alternate embodiment of the movement inhibitor; and

FIG. 5 is a perspective view of the cartridge of FIG. 4 showing the door in the closed position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

FIG. 1 shows a tape cartridge 10 according to the invention for use with a tape drive 12 having an actuation member 14. The cartridge 10 includes a supply reel 16 rotatably mounted on a cartridge body 18. A length of magnetic tape 20 is wound on the supply reel 16, and a leader 22 is attached to a free end of the tape 20.

Referring to FIGS. 1 and 2, the cartridge body 18 supports the supply reel 16 and is configured to be inserted into the tape drive 12. The cartridge body 18 includes first and second adjacent faces 24 and 26, respectively, that extend at an angle to each other. In the embodiment shown in FIGS. 1 and 2, for example, the first face 24 is generally perpendicular to the second face 26. The first face 24 has a first opening 28 through which the tape 20 and leader 22 may travel. The second face 26 has a second opening 30 for allowing access to the leader 22, as explained below in detail.

The cartridge 10 further includes a door 32 movably associated with the cartridge body 18. For example, the door 32 may be pivotably mounted on a post 33 of the cartridge body 18. Moreover, the door 32 is movable between a closed position, shown in FIG. 1, and an open position, shown in FIG. 2, for allowing extraction of the leader 22 and tape 20.

In the closed position, the door 32 at least partially covers the first opening 28. The door 32 may also at least partially cover the second opening 30 when the door 32 is in the closed position. In the embodiment shown in FIG. 1, for example, the door 32 includes a main body 34 having first and second portions 35 and 36, respectively, that completely cover the first and second openings 28 and 30, respectively, when the door 32 is in the closed position.

Upon insertion of the cartridge 10 into the drive 12, the first portion 35 engages the actuation member 14, which causes the door 32 to pivot from the closed position to the open position. The door 32 may also include a retainer 38 that is engageable with the actuation member 14 when the door 32 is in the open position to facilitate retention of the cartridge body 18 in the tape drive 12. For example, the retainer 38 may be formed as a recess that engages a protrusion 40 of the actuation member 14 when the door 32 is in the open position. More specifically, referring to FIG. 3, the retainer 38 may include an angled surface 42 that engages an angled surface 44 of the protrusion 40 when the door 32 is in the open position.

Alternatively, the retainer 38 may have any suitable configuration that cooperates with the actuation member 14 to facilitate retention of the cartridge body 18 in the tape drive 12. For example, the retainer 38 may be formed as a protrusion that is engageable with a recess formed on the actuation member 14.

The cartridge 10 may further include a closure member 46 associated with the door 32 and configured to apply a closure force on the door 32, to thereby urge the door 32 toward the closed position. For example, the closure member 46 may be a torsion spring disposed about the post 33 and engaged with the drive body 18 and the door 32.

In addition, the cartridge 10 may include a movement inhibitor 48 associated with the cartridge body 18 and engageable with the door 32 when the door 32 is in the open position for inhibiting movement of the door 32 toward the closed position. For example, the movement inhibitor 48 may be a flexible member, such as a spring, attached to or otherwise disposed on the drive body 18. Furthermore, the movement inhibitor 48 may include an engaging portion 50 that engages a protrusion 52, formed on the first portion 35 of the door 32, when the door 32 is in the open position.

The movement inhibitor 48 may have a spring force that is greater than the closure force applied by the closure member 46, such that the movement inhibitor 48 sufficiently holds the door 32 in the open position. When the spring force is sufficiently exceeded, the door 32 may move toward the closed position.

FIGS. 4 and 5 show an alternate embodiment 48' of the movement inhibitor. The movement inhibitor 48' is formed as a flexible projection, such as a post, that extends from the cartridge body 18. The movement inhibitor 48' may be attached to the cartridge body 18 in any suitable manner, such as with adhesive or a fastener. Alternatively, the movement inhibitor 48' may be integrally formed with the cartridge body 18. For example, the movement inhibitor 48' and a portion of the cartridge body 18 may be formed in a molding operation, such as an injection molding operation.

Alternatively or supplementally, engagement of the door 32 with the actuation member 14 may inhibit movement of the door 32 toward the closed position. For example, the retainer 38 and/or extension 53 may function to inhibit movement of the door 32.

Referring to FIG. 1, the tape drive 12 is configured to receive the cartridge 10 and to perform read and/or write operations on the tape 20. For example, the tape drive 12

may include a threading mechanism (not shown), such as a buckling mechanism, for engaging the leader 22 and for routing the leader 22 to a take-up reel (not shown). The tape drive 12 may then function to route the tape 20 across one or more read and/or write heads (not shown) for performing read and/or write operations on the tape 20.

The actuation member 14 may be mounted on any suitable portion of the tape drive 12. For example, the actuation member 14 may be fixed to a shuttle or elevator 54 that receives the cartridge 10 and moves the cartridge onto a drive hub (not shown) of the tape drive 12.

Operation of the cartridge 10 and tape drive 12 will now be described. First, the cartridge 10 may be inserted into the tape drive 12, either manually or automatically. For example, an automatic insertion/extraction device, such as a library hand (not shown), may automatically insert the cartridge 10 into the tape drive 12 in a first direction 56 generally perpendicular to the first face 24. When the cartridge 10 is inserted into the tape drive 12, the actuation member 14 engages the door 32 and urges the door 32 to pivot from the closed position to the open position.

In the open position, the door 32 engages the movement inhibitor 48, which sufficiently inhibits rotation of the door 32 toward the closed position. As a result, the door 32 is trapped against the actuation member 14 such that the retainer 38 of the door 32 sufficiently retains the cartridge 10 in the tape drive 12.

Once the door 32 is moved to the open position, the threading mechanism of the tape drive 12 may engage the leader 22 and route the leader 22 and the tape 20 to the take-up reel of the tape drive 12. For example, the threading mechanism may include a machine leader that is configured to extend through the first opening 28 and/or second opening 30, and buckle or otherwise connect to the leader 22. After connecting to the leader 22, the threading mechanism may route the leader 22 and tape 20 along a tape path (not shown) of the tape drive 12 to the take-up reel. Read and/or write operations may then be performed on the tape 20.

When it is desired to remove the cartridge 10 from the tape drive 12, a removal force may be applied to the cartridge 10 either manually or automatically. For example, a library hand may automatically extract the cartridge 10 from the tape drive 12. As a result, the spring force of the movement inhibitor 48 is overcome, and the door 32 is free to close with the assistance of the closure member 46. More specifically, as the cartridge 10 is extracted from the tape drive 12, the angled surface 44 of the actuation member 14 may engage the angled surface 42 of the door 32 and urge the door 32 toward the closed position, thereby disengaging the door 32 from the movement inhibitor 48.

With the configuration described above, the retainer 38, either alone or in cooperation with the movement inhibitor 48, may function to sufficiently retain the cartridge 10 in the tape drive 12. As a result, movement of the cartridge 10 due to such factors as environmental vibrations and/or drag forces applied by a library hand following cartridge insertion may be reduced or eliminated.

Advantageously, the cartridge 10 and actuation member 14 may be configured to achieve any desired retention force for the cartridge 10. For example, the cartridge 10 and actuation member 14 may be configured to achieve a retention force of one pound or less. Thus, in order to remove the cartridge 10 from the tape drive 12, a removal force in excess of the retention force would need to be applied to the cartridge 10, either manually or automatically.

Moreover, because the movement inhibitor 48 inhibits rotation of the door 32, ejection of the cartridge 10 resulting

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from the closure member **46** acting on the door **32** is inhibited. More specifically, the movement inhibitor **48** may prevent the door **32** from pivoting toward the closed position and pushing the cartridge **10** out of the tape drive **12**.

In addition, because the actuation member **14** extends into the cartridge **10** when the cartridge **10** is inserted into the tape drive **12**, the tape drive **12** may not accept cartridges that do not have an opening for receiving the actuation member **14**. Thus, the actuation member **14** may function as a “keep out” mechanism for preventing undesired cartridges from being inserted into the tape drive **12**.

While embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrate and describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A tape cartridge for use with a tape drive having an actuation member, the cartridge comprising:

a cartridge body that is insertable into the tape drive; and a door movably associated with the cartridge body and being engageable with the actuation member when the cartridge body is inserted into the tape drive, the door being movable between a closed position and an open position upon engagement with the actuation member, the door including a retainer that is engageable with the actuation member when the door is in the open position to facilitate retention of the cartridge body in the tape drive;

wherein the cartridge body includes first and second faces that extend at an angle to each other, the first face having a first opening and the second face having a second opening, and wherein the door has first and second portions that at least partially cover the first and second openings, respectively, when the door is in the closed position.

2. The cartridge of claim **1** further comprising a movement inhibitor associated with the cartridge body and engageable with the door when the door is in the open position for inhibiting movement of the door toward the closed position.

3. The cartridge of claim **2** wherein the movement inhibitor comprises a spring attached to the cartridge body.

4. The cartridge of claim **2** wherein the movement inhibitor comprises a flexible projection on the cartridge body.

5. The cartridge of claim **2** wherein the door comprises a main body and a protrusion on the main body, the protrusion being engageable with the movement inhibitor.

6. The cartridge of claim **1** wherein the retainer comprises an angled surface that is engageable with an angled surface of the actuation member.

7. The cartridge of claim **1** wherein the retainer comprises a recess that receives a protrusion of the actuation member.

8. The cartridge of claim **1** wherein the first opening is configured to receive the actuation member when the cartridge body is inserted into the tape drive.

9. The cartridge of claim **1** further comprising magnetic tape associated with the cartridge body, a spring associated with the door for urging the door toward the closed position, and a locking mechanism that is engageable with the door when the door is in the open position for inhibiting movement of the door toward the closed position, wherein the first opening of the cartridge body is configured to allow the tape to pass therethrough, the door is pivotable between the closed position and the open position upon engagement with

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the actuation member, and wherein the retainer and the locking mechanism are configured to cooperate to sufficiently retain the cartridge body in the tape drive.

10. The cartridge of claim **1** wherein the retainer is engageable with the actuation member when the door is in the open position to inhibit removal of the tape cartridge from the tape drive.

11. A tape cartridge for use with a tape drive having an actuation member, the cartridge comprising:

a cartridge body that is insertable into the tape drive; a door movably associated with the cartridge body and being engageable with the actuation member when the cartridge body is inserted into the tape drive, the door being movable between a closed position and an open position upon engagement with the actuation member; and

a movement inhibitor associated with the cartridge body and engageable with the door when the door is in the open position for inhibiting movement of the door toward the closed position.

12. The cartridge of claim **11** wherein the movement inhibitor comprises a spring attached to the cartridge body.

13. The cartridge of claim **11** wherein the movement inhibitor comprises a flexible projection on the cartridge body.

14. The cartridge of claim **11** wherein the door comprises a main body and a protrusion on the main body, the protrusion being engageable with the movement inhibitor.

15. The cartridge of claim **11** wherein the cartridge body includes first and second faces that extend at an angle to each other, the first face having a first opening and the second face having a second opening, and wherein the door has first and second portions that at least partially cover the first and second openings, respectively, when the door is in the closed position.

16. The cartridge of claim **15** wherein the first opening is configured to receive the actuation member when the cartridge body is inserted into the tape drive.

17. A tape cartridge and tape drive combination comprising:

a tape cartridge including a cartridge body having first and second faces that extend at an angle with respect to each other, the first face including a first opening and the second face including a second opening, the tape cartridge further including a door movably associated with the cartridge body and being pivotable between a closed position and an open position, the door having first and second portions that at least partially cover the first and second openings, respectively, when the door is in the closed position; and

a tape drive configured to receive the tape cartridge and including an actuation member that engages the door and urges the door toward the open position when the tape cartridge is inserted into the tape drive, wherein the actuation member extends into the first opening when the door is in the open position.

18. The combination of claim **17** wherein the door includes a retainer that is engageable with the actuation member when the door is in the open position to facilitate retention of the tape cartridge in the tape drive.

19. The combination of claim **18** wherein the door includes a main body that at least partially covers the first opening of the cartridge body when the door is in the closed position, and the retainer is fixed with respect to the main body.

20. The combination of claim **17** wherein the tape cartridge further includes a movement inhibitor associated with

the cartridge body and engageable with the door when the door is in the open position for inhibiting movement of the door toward the closed position.

21. The combination of claim 17 wherein the tape cartridge further includes a magnetic tape and a leader attached to the tape, and wherein the first opening is configured to allow the leader and the tape to pass therethrough, and the second opening is configured to allow access to the leader.

22. A tape cartridge for use with a tape drive having an actuation member, the cartridge comprising:

- a cartridge body that is insertable into the tape drive; and
- a door movably associated with the cartridge body and being engageable with the actuation member when the cartridge body is inserted into the tape drive, the door being movable between a closed position and an open position upon engagement with the actuation member, the door including a retainer that is engageable with the actuation member when the door is in the open position to facilitate retention of the cartridge body in the tape drive;

wherein the cartridge body has an opening, and the door at least partially covers the opening when the door is in the closed position, and wherein the opening is configured to receive the actuation member when the door is in the open position and the cartridge body is inserted into the tape drive.

23. A tape cartridge for use with a tape drive having an actuation member, the cartridge comprising:

- a cartridge body that is insertable into the tape drive; and
- a door movably associated with the cartridge body and being engageable with the actuation member when the cartridge body is inserted into the tape drive, the door being movable between a closed position and an open

position upon engagement with the actuation member, the door including a retainer that is engageable with the actuation member when the door is in the open position to facilitate retention of the cartridge body in the tape drive, wherein the door includes a main body, and the retainer is fixed with respect to the main body.

24. The cartridge of claim 23 further comprising a supply reel supported by the cartridge body and magnetic tape coupled to the supply reel, and wherein the cartridge body has an opening through which the tape may travel, and the main body of the door at least partially covers the opening when the door is in the closed position.

25. A tape cartridge and tape drive combination comprising:

- a tape cartridge including a cartridge body having an opening, the tape cartridge further including a door movably associated with the cartridge body and being pivotable between a closed position and an open position, wherein the door at least partially covers the opening when the door is in the closed position, the tape cartridge also including a movement inhibitor associated with the cartridge body and engageable with the door when the door is in the open position for inhibiting movement of the door toward the closed position; and
- a tape drive configured to receive the tape cartridge and including an actuation member that engages the door and urges the door toward the open position when the tape cartridge is inserted into the tape drive, wherein the actuation member extends into the opening when the door is in the open position.

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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 7,077,353 B1
APPLICATION NO. : 10/746160
DATED : July 18, 2006
INVENTOR(S) : William T. Veno et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title Page; item (60)

On the face of the patent under the Section entitled "Related U.S. Application Data" and after "Nov.", please delete "4" and insert --5--.

Signed and Sealed this

Fourth Day of December, 2007

A handwritten signature in black ink on a light gray dotted background. The signature reads "Jon W. Dudas" in a cursive style.

JON W. DUDAS

Director of the United States Patent and Trademark Office